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NOTES ON THE GEOLOGY OF THE SUN RIVER DISTRICT, MONTANA

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While making a geological examination last fall for the location of an irrigation dam on the North Fork of the Sun River, Montana, Professor W. O. Crosby made a careful collection of some fossils. The latter have been identified by the writers and they form the basis of these notes.

The Sun River has its origin in the Livingston Range and flows eastward to Great Falls. The district in which the fossils were collected, lies in the southern half of the Saypo atlas sheet, about 65 miles west of Great Falls. Owing to the paucity of names in this region, the Sun River is divided into a North Fork and a South Fork. These forks are in turn subdivided into North and South Forks. As only the North Fork of the Sun River is shown on the Saypo sheet, references will be made directly to the Sun River, implying the North Fork of this stream.

In the region near Milk River, about 70 miles northwest of the Sun River, Willis found one large overthrust of the Algonkian upon the Cretaceous.¹ It is probable that this overthrust divides into several smaller thrusts before reaching the Sun River.

There are nine N-S. "reefs" or ridges from the junction of the Sun River with its South Fork east to the Cretaceous plains. The indications are that each of these parallel ridges represents an overthrust to the east. Besides the field evidence of this structure is the evidence furnished by the stratigraphic position of the fossils. These were collected at too few points to show the existence of more than five faults. The fossils indicate a fault both east and west of the Dam Site. There is evidence also of a fault to the east of Arsenic Reef and of another separating the two ridges of Arsenic

¹ G. S. A. Bull. 13, 1902, p. 305-52.

Reef. The fifth is an overthrust of the easternmost reef, the Carboniferous being found to overlies the Cretaceous. The reef west of the Dam Site—Black Reef—consists of monzonite. So far as known nothing has previously been published bearing on the geology of the Saypo quadrangle.

The fossils were collected from five localities which are numbered from west to east as on the accompanying map.

Locality 1.—At the big bend in the South Fork of the Sun River just north of the junction of Goat Creek with this stream. Embedded in a dark arenaceous shale were found:

Inoceramus labiatus Schlotheim, c.¹

Lingula sp. c.

The horizon is probably Coloradoan Cretaceous.

Locality 2.—Immediately northwest of the junction of the Sun River with its South Fork. The rock here is a shaly, fine-grained sandstone.

Pleuromya subcompressa Meek C.

P. subcompressa webberensis M. and H., r.

Gryphaea calceola nebrascensis M. and H., r.

Pteria sp. R.

Ammonite, R.

The horizon is Ellis (Jurassic).

Locality 3.—At the Dam Site, just east of the junction of the Sun River with its South Fork. The rock is a dense brownish-gray limestone. The fossils are quite thoroughly silicified.

Syringopora surcularia Girty, c.

Lithostrotion whitneyi Meek, c.

Zaphrentis sp., c.

Productus semireticulatus (Martin), R.

Spirifer centronatus A. Winchell, C.

The horizon is Madison (Mississippian).

Locality 4.—Arsenic Reef lies west of Big George Gulch. At the Sun River valley it divides into two parallel ridges. On the western ridge Professor Crosby noted *Syringopora* and *Zaphrentis* in a hard limestone. It is therefore probably Madison in age.

¹ C. indicates that the fossils collected are very abundant; c, abundant; r, rare; and R, very rare.



FIG. 1.—Map of a portion of the Saypo Quadrangle showing the fossil localities described in this paper. The localities are numbered 1 to 5.

On the eastern ridge is a softer, brownish limestone containing:

Atrypa missouriensis Miller, C.

Spirifer coniculus Girty, C.

The *Spirifer* indicates an Ouray (Devonian) age.

The *Atrypa* has been reported from the Three Forks (Devonian) shale in which it is abundant in the Yellowstone National Park area. It occurs in a finer-grained and slightly browner limestone than does the *Spirifer*. These two fossils have not been noted on the same piece of rock.

Locality 5.—The easternmost reef consists, according to Professor Crosby, of limestone containing the same corals—*Zaphrentis*, *Syringopora*, etc.—as are present at locality 3 and at the western ridge of Arsenic Reef, locality 4.

This limestone reef is, according to Professor Crosby, overthrust upon the Cretaceous beds to the east. One-fourth of a mile from the eastern edge of the reef a vertical drill core showed the Cretaceous shale beneath the limestone. The Cretaceous near the limestone is slightly folded, but farther east it is approximately horizontal.